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Construction and Economic Aspects of Bullet Train in Comparative Analysis with Conventional Train

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Abstract: *As one of India's most ambitious projects, a High-Speed Rail (HSR) line between Mumbai and Ahmadabad, gains attraction, the country is poised to create history. On the Global HSR, take a major step forward in terms of development and join the league of industrialized nations. Highway gridlock, airport delays, and unpleasant journeys will soon be a thing of the past. Our very own 'bullet' train, so named because of its bullet- like shape and speed, will be tearing through the landscape of west India, traversing the 508 kilometer trip between the two financial capitals in just over two hours. When compared to existing journey times of roughly nine hours (by bus) or six hours (by train), this will save a significant amount of time (by conventional railways). The HSR project will completely transform this environment and will affect the way we Indians travel. The state-of-the-art high-speed trains, based on Japanese Shinkansen technology, will travel at 320 km/h, more than twice the speed of Indian Railways' fastest train, the Gatiman Express, which travels at 160 km/h, and we, as passengers, will get to experience one of the best HSR technologies available globally, providing the highest levels of safety, comfort, and reliability as we board this train.*

Keywords: Bullet Train, High Speed Rail, Speed

I. INTRODUCTION

The history of Indian Railways dates back more than 160 years. The first passenger train ran between Bori Bunder (Bombay) and Thane, a distance of 34 kilometres, on April 16, 1853. It had thirteen carriages and was operated by three locomotives named Sahib, Sultan, and Sindh. Railways were used to transport both passengers and goods. After a few years, as the population grew, so did the demand for goods. The newly arrived trains at a higher speed were also running on the same tracks, so the construction of a bullet train can be said to be necessary despite prosperity because it includes transportation of passengers on its own individual track and also consumes less time in journey with moderate ticket prices.

HSR is needed as a measure to archive several goals and demands indicated in Railway Vision with its various features 6 main items which HSR will satisfy are written blow:

1. **Safety:** As indicated in Railway Vision 2020, HSR System needs to aim at making railway operations free of accidents, derailment, collision or fire on trains. Safety is highly required for HSR. HSR has been established as very safe transport system mainly in East Asia and Europe since Shinkansen was opened in 1964 in Japan. HSR is required for safety transport network in India.
2. **High Capacity/Frequency:** As indicated passenger transport activity is growing rapidly in India and its growth is driven by rapid population growth, economic growth, urbanization and motorization.

   BPKM=Billion Passenegrs -kms

   *Estimation by different Ministries and Planning Commission. Estimations are on higher side as compared to much other estimation.

   High Speed Rail, Rapid Train, Commuter Train, Bus, Regional Train, Private Car, Plane
3. **Network Expansion:** As per the Railway Vision 2020, new 25,000km railway line will be constructed by 2020 to expand and strengthen the railway network in India. HSR will also be a part of this expansion and 4 HSR Corridors out of 7 corridors planned in India are to be constructed by 2020. HSR strengthen transport network between major cities in the world with its high-speed performance and mass transport performance and it is expected that HSR will strengthen transport network of major cities in India.

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4. **High Energy Efficiency:** As indicated in Railway Vision 2020, Indian Railways has made efforts to reduce carbon footprint for climate protection by some measures. HSR is a mode with high energy efficiency compared with other modes.

HSR as an environment-friendly measure matches the way which Indian Railways goes to protect environment including energy serving and reduction in carbon emission.

The Indian rail is considered to be the single largest user of the electrical power in the country. It has one of the largest rail networks in the world. It has a large fleet of trains, which includes diesel and electric engines, and a requirement of a high capacity of transportation for passengers and goods. Its passage through huge sections of forests and its impact adversely affects these forests. Curbing the consumption of fuel per ton per mile by the railways, would have substantial environmental impact and would be single greatest contributor for energy conservation. There are many factors which hurdles in increasing the speed of trains. These are as follows-

1. Old technology and infrastructure, which are still using track building and other subtle foundation of the infrastructure.
2. Poor coupling technique which decreases the stability and permit of high speed transportation.
3. Unreliable tracks, in some sections trains can't even touch 100 km/h speed falling against the dream of achieving 200-250 km/h.
4. Economy does not support investment in new infrastructure.
5. Potential commuters constitute very less percentage as compared to current number.
6. Large distance between major cities.

Our present technology is sufficient to cross the threshold of 200 km/hr, as seen on Delhi-Agra. The system can be made more reliable by having solid track foundation, improved coupling system and by decreasing length of trains.

II. Comparison between HSR and Conventional Railways

- High Speed Rail, which operates at a maximum commercial speed of 320km/h worldwide, was created by combining technologies that differ from those used in conventional lines. Because rolling stock vibrates more and, in the event of an accident, the damage will be massive due to its high speed, more precise technologies should be introduced to achieve safe high- speed operation.
- It is written that a high-speed rail system is made up of subsystems that are very different from a conventional line. From the beginning of its development, High Speed Rail technology has been developed to achieve much faster speed operation than conventional lines. A variety of modern technologies, such as the structure and maintenance methodology of track, rolling stock, electrification system and Automatic Train Control (ATC), etc. have been adopted
- In terms of track, there have been instances of track irregularity caused by high lateral force generated by high speed operation, and technical development in track maintenance to deal with such a problem of high lateral force has been created. As of right now,
- In terms of track, there have been instances of track irregularity caused by high lateral force generated by high speed operation, and technical development in track maintenance to deal with such a problem of high lateral force has been created.
- When compared to a conventional line, the ballast-less track has a much stricter maintenance standard have been implemented in order to achieve safe high-speed operation. In terms of rolling stock, technological advancements in terms of high-speed running resistance include, adhesion coefficient, running stability, pantograph power collection, bearing metal, wind When the train enters the tunnel, there is pressure, and trains in opposite directions pass by. Braking distance, for example, has been developed. Aerodynamically shaped rolling stock and a complex body structure has been created.
- In the field of electricity, there has been the development of technologies such as a centenary structure that can withstand high speed and frequent operation, as well as the enforcement of its material, the compounding of centenary, and the installation of vibration reduction equipment to reduce the vibration caused by high speed operation. HSR's dependability has been improved. To achieve safe high-speed operation, for example, Automatic Train Control (ATC) has been created and installed, which displays signal on the indicator in the rail car (cab signal)

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and interlocks brake with cab signal because there is no margin for error.

III. CONSTRUCTION ASPECTS

Aspects	Bullet Train	Conventional Train
Time of travel	Less time	More time
Cost of travel	Moderate	Less
Safety	More	Moderate
Speed	250 to 350 km/hr.	160km/hr
Stops	Less no of stoppages	More no of stoppages
Construction	Elevated corridors	On ground
Tracks	Ballastless tracks	Basllasted tracks
Spans	Precast	Cast in Situ
Land Acquisition	Less land required	More land required
Machinery	New equipment's introduced	Old methods adopted
Money	JICA	Government

3.1 Infrastructure

Speed trains or bullet trains are trains that travel at speeds of 250 kmph or higher. Speed limits may also be reduced for safety reasons. These bullet trains can be found in 16 different countries. China has the world's longest high-speed train track, measuring 27000 kilometres. Other countries, such as Germany and France, have 1000-kilometer-long tracks dedicated to high- speed trains.

3.2 Tracks

There are some tracks built specifically for bullet trains. Other tracks have also been upgraded to allow for the operation of high-speed trains. Tracks built specifically for high-speed trains should have a speed limit of at least 250 km/hr.

A. Why trains are still necessary?

On the other hand, on tracks that have been upgraded for high speed trains, a speed limit of 200 km/hr is to be maintained. The bullet trains have been observed to run on conventional tracks in the majority of cases. These tracks, on the other hand, are made of much stronger materials. On these tracks, the train must have a total of two engines or power cars. These are located on both ends. Certain pantographs are mounted on the roofs, and these provide power to the trains. A larger portion of the regular routine alignments are also kept straight, which facilitates high speed. While most countries have dedicated tracks for these bullet trains, they can also travel on other modes of transportation.

B. Technology Used

These trains also generate thrust, and it is this thrust that allows the trains to move. These trains also have better controls because neither the brakes nor the acceleration are affected by friction between the tracks.

3.3 Normal Train

The trains that run on the ballasted tracks and have a speed of around 160 kmph and in some case a speed of 200 kmph is the normal trains.

A. Infrastructure

The normal trains are the ones that have changed the background of the transportation. This happened when locomotive was launched in England for the first time in the year 1797. The locomotive is that part of the train that helps the other train parts to move. It was just after that the railroads started being constructed.

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B. Operation

Moreover, both the freight cars as well as the passenger cars were connected to the steam. The operation of the steam locomotives depended completely on the burning coal. This was used to heat the water in the boiler. When the water vaporized then the steam came out through the valves. This would help the piston move back and forth. The piston motion was then transferred to the train wheels and this powered the movement of the train.

C. Working Process

The steam engines were then replaced by new technology. It was during this time that the diesel engines came into existence. After that, there were certain engines that started running on electricity. These were the ones that actually replaced the diesel engines at a later stage.

IV. Economic Aspects

The MAHSR project is expected to cost INR 1,08,000 crore (USD 17 billion) and will be carried out with JICA's Official Development Assistance (ODA) Loan assistance. A government-to-government cooperation agreement was signed in December 2015 between India and Japan to bring Shinkansen technology to India for project implementation. Following the diplomatic exchanges, an amount of umbrella funding was allocated, with the understanding that loans will be disbursed as and when the amounts are required with the signing of individual loan agreements.

The Government of Japan will fund 81% of the overall capital structure, while the Government of India will fund the remainder (GoI). According to the SPV's equity structure, the Government of India owns 50% through the Ministry of Railways, with the remaining 25% held by the governments of Maharashtra and Gujarat. The MAHSR project is one of JICA's flagship projects, accounting for nearly half of their portfolio in India despite the fact that they are heavily invested in the country.

The loan terms for the MAHSR are very appealing. It is a 50-year loan at 0.1 percent, a rate that is unusual in JICA's portfolio. This includes a 15 -year moratorium on loan repayment, followed by 35 years of interest-bearing loan repayment. It is a concessional rate offered to India for the HSR project after the Japanese Cabinet granted special approval."

To make way for the construction of the MAHSR corridor, NHSRCL must acquire nearly 1,400 hectares of land in the states of Gujarat and Maharashtra, as well as the Union Territory of Dadra and Nagar Haveli, that falls into four broad categories: private, government, railway, and forest land. Resettlement and rehabilitation of Project Affected Families are also part of the land acquisition process. The complexity of this issue is extremely high for the MAHSR project. More than 4,000 families must be resettled across two states, one union territory, 12 districts, and approximately 1,400 hectares of land. When compared to another project of this scale, such as the construction of an international airport in Jewar, the number of villages affected is only eight, as opposed to 297 in this case.

To ensure that the process is completely transparent, all affected families must be compensated or provided with the necessary accommodations, which must be calculated using an entitlement matrix. Land acquisition in Maharashtra is based on government orders, and NHSRCL follows the Competent Authority of Land Acquisition (CALA) system, in which the State government is entrusted with the power to acquire the land and NHSRCL is only the paying authority. A three-tiered arrangement has been devised to ensure the timely payment of compensation amounts to the thousands of beneficiaries from whom land will be acquired for the project. Three bank clusters – ICICI, HDFC, and SBI – have been chosen to disburse payments, and for each cluster, a daily estimate has been prepared from which funds are transferred to Land.

V. Results and Discussion

Due to all the above aspects we have a conclusion that Bullet Train is future of India and this project will bring benefits to people from various sectors.

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REFERENCES

[1]. P. R. Shukla, Minal Pathak, Shivika Mittal, and Subash Dhar (2015), Scenarios and Roadmap for Intercity Transport in India: The Role of High Speed Rail, Promoting Low Carbon Transport in India, UNEP with Indian Institute of Management, Ahmedabad, September 2015

[2]. S. Ramesh, K.Joseph Raj (2014), A study of Indian railways networks and approaches to implement the bullet trains in Indian scenario, International Journal of Electrical, Electronics and Computer Systems, ISSN (Online): 2347- 2820, Volume -2, Issue-10 2014

[3]. Shubham Sharma, Annu (2015), Future of High Speed Trains in India and Its Comparative Study with Japan, France, Germany and South Korea, IOSR Journal of Mechanical and Civil Engineering, ISSN: 2278-1684, Volume 12, Issue 5 Ver. III (Sep. - Oct. 2015), PP 19-23

[4]. SrinandJha (2014) Article, In future, Delhi to Chennai in 6 hrs by Train, Hindustan Times, New Delhi, November 14, 2014

[5]. Sunil Kumar Sharma. Anil Kumar (2014), A Comparative Study of Indian and Worldwide Railways, National Conference on "Recent Advances in Mechanical Engineering" RAME - 2014, ISSN 2278 - 0149 www.ijmerr.com, Special Issue, Vol. 1, No. 1,

[6]. ISSN 2278 – 0149 www.ijmerr.com Special Issue, Vol. 1, No. 1, January 2014"Comparative Study of Indian Railways and Worldwide Railways" National Conference on "Recent Advances in Mechanical Engineering" RAME 2013 © 2014 IJMERR. All Rights Reserved Int. J. Mech. Eng. & Rob. Res. 2014 Centre

[7]. International Journal of Trend in Research and Development, Volume 3(3), ISSN: 2394-9333

[8]. www.ijtrd.com A Study on High Speed Rails in India J. Priyadharshini and M. Selladurai' Associate Professor. 'Doctoral Research Scholar PG Department of Commerce. AJK College of Arts & Science. Coimbatore, Tamil Nadu, India it's a critical assignment in developing the high speed rail network in India

[9]. https://www.nhsrcl.in/en/project/mahsr-project-operational-planss (25/01/2022 8:15am) NHSRCL Institute Detailed Study On High Speed Rails In India Engineering Jaipur Engineering College And Research Center. Jaipur, Rajasthan, India Dedicated High Speed Rail Network in India: Issues in Development G Raghuram Professor, Public Systems Group Indian Institute of Management Ahmedabad Email: graghu@iima.ac.in Prashanth D Udayakumar Research